

## RAMASWAMY CHANDRASHEKAR, MS., Ph.D.

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### PROFESSIONAL EXPERIENCE

#### IDEXX LABORATORIES, WESTBROOK, MAINE

##### **RESEARCH SCIENTIST-II, RAPID ASSAY GROUP, INFECTIOUS DISEASES R&D (2002-PRESENT)**

Leading a group responsible for R&D of Point Of Care of Testing devices for companion animals.

#### HESKA CORPORATION, FORT COLLINS, COLORADO

##### **SENIOR SCIENTIST AND GROUP LEADER, Diagnostic Research (1998-2002)**

Management of molecular- and immuno-diagnostic group. Supervised a group of five Scientists (including two Ph.D. Scientists). Designed, developed, and evaluated molecular and immunodiagnostic assays for the diagnosis of parasitic and infectious agents in companion animals. Developed, optimized, and validated immunoassays for cancer markers. Project management: primary person responsible for the management and coordination of projects under aggressive time-lines. Responsible for transfer of assays, documentation and SOPs. Interacted extensively with groups within the company (process and regulatory groups) and outside the organization (external scientific/technical collaborations with both academia and industry).

##### **ACCOMPLISHMENTS**

Participated in the research and/or development of the following *Heska* products and reagents:

- *Heska*<sup>TM</sup> Canine *Ehrlichia* sp. PCR Test (offered as a service in the Heska's Reference Veterinary Diagnostic Laboratory).
- *Heska*<sup>TM</sup> Feline ImmuCheck<sup>TM</sup> Assay (Vaccine Titer Assay) (offered as a service in the Heska's Reference Veterinary Diagnostic Laboratory).
- *Heska*<sup>TM</sup> Equine *Streptococcus equi* PCR Test (offered as a service in the Heska's Reference Veterinary Diagnostic Laboratory).
- *Heska*<sup>TM</sup> Canine Heartworm Antigen Test (offered as a service in the Heska's Reference Veterinary Diagnostic Laboratory).
- *Heska*<sup>TM</sup> SoloStep<sup>TM</sup> CH (USDA Licensed Canine Heartworm Diagnostic POCT).
- *Heska*<sup>TM</sup> SoloStep<sup>TM</sup> FH (USDA Licensed Feline Heartworm Diagnostic POCT).
- Seven patents pending.
- Identified several potential diagnostic targets for a fecal diagnostic kit for intestinal helminth infections.

##### **SENIOR SCIENTIST, Nematode Vaccines and Diagnostics (1995-1998)**

Management of vaccine antigen discovery and testing group. Supervised one post-doctoral and five associate scientists. Conducted basic research on the biology/ biochemistry/immunology/proteomics of parasitic nematodes to identify potential vaccine antigens. Molecular cloning and expression of recombinant nematode vaccine antigens. Designed and coordinated several animal studies for vaccine efficacy trials (dogs and cats). Antigen discovery research for heartworm diagnostics.

##### **ACCOMPLISHMENTS**

- Identified and characterized over ten potential vaccine candidate nematode antigens against heartworm infections for clinical trials in dogs/cats.
- Five potential recombinant antigens identified by proteomics and cloned for diagnostic evaluation in antibody detection ELISA for feline heartworm infections.
- 13 Patents issued and one pending.

#### WASHINGTON UNIVERSITY, ST. LOUIS, MISSOURI

**RESEARCH ASSISTANT PROFESSOR, Dept. of Medicine and Molecular Microbiology (1995)**

**RESEARCH INSTRUCTOR, Dept. of Medicine and Molecular Microbiology (1991-1995)**

Responsible for immunodiagnostic assay development and vaccine discovery studies in parasitic nematode infections. Field evaluation of diagnostic tests in Egypt. Supervised science technicians.

#### ACCOMPLISHMENTS

- Developed recombinant antigen-based antibody ELISAs for the diagnosis of human nematode infections. Evaluation of both assays extensively in field studies in Africa.
- Developed a monoclonal antibody-based antigen-based diagnostic assay for human onchocerciasis (river blindness) to detect circulating parasite antigens both in blood and urine.
- Developed a recombinant antigen-based immunoblot assay for diagnosis of Histoplasmosis.
- Identified and tested several candidate recombinant vaccine antigens in animal model of filarial nematode infections.
- One Patent issued and one pending.

#### NATIONAL/INTERNATIONAL SCIENTIFIC ACTIVITIES

- Invited Participant-WHO: Filariasis Scientific Working Group (UNDP/World Bank/World Health Organization), 1991, 1994. "Protective immunity studies in Onchocerciasis.
- Chairperson: Chaired the scientific session in Filarial Biology. Joint Annual Meeting of the American Society of Tropical Medicine and Hygiene and The American Society of Parasitologists, Atlanta, Georgia. October 31-November 4, 1993.
- Advisor-WHO: Special Program for Research & Training in Tropical Diseases (TDR), World Health Organization, 1993, 1994. Transferred technology from lab research to product development.
- Consultant and collaborating scientist, Epidemiology and Control of Vector Borne Diseases in the Middle East (Egypt-Israel-USA) (USAID/NIH), 1990-1994. Transferred immunodiagnostic assays for lymphatic filariasis from laboratory to field for evaluation studies in Egypt.
- Collaborating Scientist, Participated in protective immunity studies in human filariasis-*International Collaborations in Infectious Disease Research Project (NIH)* to study immunity to filariasis in humans with a longitudinal study of carefully defined populations in a highly endemic region of Egypt, 1994-1995.

#### POST-DOCTORAL RESEARCH ASSOCIATE (Jewish Hospital of St. Louis at Washington University) (1988-1991)

Identified, characterized and generated monoclonal antibodies to circulating parasitic nematode antigens; Developed antigen detection and recombinant antigen-based antibody assays for human infectious diseases. Participated in a Recombinant DNA Technology Workshop conducted by the *New England Biolabs* and Smith College, Northampton (1991). Supervised a science technician.

#### CIBA-GEIGY RESEARCH CENTER, BOMBAY, INDIA

SENIOR RESEARCH ASSISTANT (1986-1988)

RESEARCH ASSISTANT (1980-1986)

#### EDUCATION

Ph.D., Biochemistry - CIBA-GEIGY Research Center, and University of Bombay, India.

MS., Zoology - University of Madras, Madras, India.

#### HONORS AND AWARDS

National Science Talent Search Scholarship, NCERT, New Delhi, India.

Joshua Gold Medal for best under graduate student.

Joshua Gold Medal and Aaron award for best post graduate student.

National Merit Scholarship, Government of India.

#### PROFESSIONAL MEMBERSHIPS

American Society of Tropical Medicine and Hygiene.

American Association for the Advancement of Science.

American Society of Parasitologists.

American Society for Microbiologists.

#### PUBLICATIONS

(SEE ADDENDUM)

Peer-reviewed-64; Invited-7

## ADDENDUM

## PUBLICATIONS

## PEER-REVIEWED

1. Rao RR, Marathe MR, **Chandrashekar R**, Subrahmanyam D: Ocular filarial infections in *Mastomys natalensis* with *Litomosoides carinii* and *Brugia pahangi*. *Indian J Parasitol* 1983;7:57-60.
2. Reddy AB, Rao UR, **Chandrashekar R**, Shrivastava R, Subrahmanyam D: Comparative efficacy of some benzimidazoles and amoscanate (Go. 9333) against experimental filarial infections. *Tropenmed Parasitol* (Germany) 1983; 34:259-262.
3. **Chandrashekar R**, Rao UR, Rajasekariah GR, Subrahmanyam D: Separation of viable microfilariae free of blood cells on Percoll gradients. *J Helminthol* 1984;58:69-70.
4. **Chandrashekar R**, Rao UR, Subrahmanyam D, Hopper K, Nelson DS, King M: *Brugia pahangi*: Serum-dependent cell-mediated reactions to sheathed and exsheathed microfilariae. *Immunology* 1984;53:411-417.
5. **Chandrashekar R**, Rao UR, Rajasekariah GR, Subrahmanyam D: Isolation of microfilariae from blood on iso-osmotic Percoll gradients. *Indian J Med Res* 1984;79:497-501.
6. **Chandrashekar R**, Rao UR, Subrahmanyam D: Effect of diethylcarbamazine on serum dependent cell-mediated reactions to microfilariae in vitro. *Tropenmed Parasitol* (Germany) 1984;35:177-182.
7. **Chandrashekar R**, Parab PB, Subrahmanyam D: The effect of p-amino-benzoic acid and folic acid on the development of infective larvae of *Brugia malayi* in *Aedes aegypti*. *Acta Trop* (Switzerland) 1984;41:61-67.
8. Reddy AB, **Chandrashekar R**, Rao UR, Subrahmanyam D: Microfilarial periodicity in *Mastomys natalensis*. *J Helminthol* 1984;58:117-121.
9. Hopper K, Subrahmanyam D, Gregory J, Nelson DS, Rao UR, **Chandrashekar R**: Mechanisms of ADCC of rat cells to microfilariae: effects of metabolic inhibitors and electron microscopic observations. *Asian Pac J Allergy Immunol* 1984;2:17-21.
10. **Chandrashekar R**, Rao UR, Subrahmanyam D, Hopper K, Nelson DS, King M: Immune reactions to exsheathed microfilariae of *Litomosoides carinii*. *Indian J Med Res* 1985;81:260-268.
11. **Chandrashekar R**, Rao UR, Subrahmanyam D: Sharing of antigens among filarial species in antibody-dependent cell-mediated cytotoxicity. *J Biosci* (India) 1985;9:191-196.
12. **Chandrashekar R**, Rao UR, Parab PB, Subrahmanyam D: *Brugia malayi*: Cell-mediated immune reactions to microfilariae. *Southeast Asian J Trop Med Public Health* 1985;16:15-21.
13. **Chandrashekar R**, Rao UR, Subrahmanyam D: Serum-dependent cell-mediated immune reactions to *Brugia pahangi* infective larvae. *Parasite Immunol* 1985;7:633-641.
14. **Chandrashekar R**, Rao UR, Arab PB, Subrahmanyam D: *Brugia malayi*: Rat-cellular interactions with infective larvae mediated by complement. *Exp Parasitol* 1986;62:362-369.
15. Rao UR, **Chandrashekar R**, Parab PB, Rajasekariah GR, Subrahmanyam D: Lectin-binding characteristics of *Wuchereria bancrofti* microfilariae. *Acta Trop* (Switzerland) 1986;44:35-42.
16. Rao UR, **Chandrashekar R**, Subrahmanyam D: *Litomosoides carinii*: Characterization of surface carbohydrates of microfilariae and infective larvae. *Tropenmed Parasitol* (Germany) 1986;38:15-18.
17. Rao UR, **Chandrashekar R**, Subrahmanyam D: Effect of Ivermectin on serum-dependent cellular interactions to *Dipetalonema viteae* microfilariae. *Tropenmed Parasitol* (Germany) 1986;38:123-126.
18. Rao UR, **Chandrashekar R**, Rajasekariah GR, Subrahmanyam D: Wheatgerm agglutinin binds to infective larvae of *Wuchereria bancrofti* but not to those of *Brugia malayi* and *Brugia pahangi*. *J Parasitol* 1987;73:1256-1258.
19. Rao UR, **Chandrashekar R**, Subrahmanyam D: Complement activation by eggs and microfilariae of filarial parasites. *Immunol Cell Biol* (Australia) 1987;65:365-370.
20. Rao UR, **Chandrashekar R**, Subrahmanyam D: Developmental changes in surface carbohydrates of filariae. *Indian J Med Res* 1988;87:9-14.
21. Parab PB, Rajasekariah GR, **Chandrashekar R**, Alkan SS, Subrahmanyam D: Characterization of a monoclonal antibody specific to the infective larvae of *Brugia malayi*. *Immunology* 1988;64:169-174.
22. Rajasekariah GR, Mukherjee P, **Chandrashekar R**, Subrahmanyam D: *Brugia pahangi*: Clearance of circulating microfilariae in immunized mice. *Immunol Cell Biol* (Australia) 1988;66:331-336.
23. Rajasekariah GR, Deshpande L, Parab PB, **Chandrashekar R**, Subrahmanyam D: *Wuchereria bancrofti* larvae in naturally infected *Culex quinquefasciatus*. *Ann Trop Med Parasitol* (Liverpool) 1988;82:637-639.
24. **Chandrashekar R**, Yates JA, Weil GJ: Use of parasite antigen detection to monitor macrofilaricidal therapy in *Brugia malayi* infected jirds. *J Parasitol* 1990;76:122-124.
25. **Chandrashekar R**, Rao UR, Subrahmanyam D: IgG response of rats to excretory-secretory products of *Litomosoides carinii*. *Parasitol Res* (Germany) 1990;76:420-423.
26. **Chandrashekar R**, Rao UR, Subrahmanyam D: Immune response to *Acanthocheilonema viteae* infection in multimammate rat (*Mastomys natalensis*). *Immunol Cell Biol* (Australia) 1990;68:21-26.
27. Weil GJ, **Chandrashekar R**, Liftis F, McVay CS, Bosshardt SC, Klei TR: Circulating parasite antigen in *Brugia pahangi* infected jirds. *J Parasitol* 1990;76:78-84.
28. Weil GJ, Ogunrinade AF, **Chandrashekar R**, Kale OO: IgG<sub>4</sub> subclass serology for onchocerciasis. *J Infect Dis* 1990;161:549-554.
29. **Chandrashekar R**, Rao UR, Subrahmanyam D: Antibody-mediated cytotoxic effects in vitro and in vivo of rat cells on infective larvae of *Brugia malayi*. *Int J Parasitol* 1990; 20:725-730.

30. **Chandrashekar R**, Ogunrinade AF, Alvarez RM, Kale OO, Weil GJ: Circulating immune-complex associated parasite antigens in human onchocerciasis. *J Infect Dis* 1990;162:1159-1162.
31. Rao UR, **Chandrashekar R**, Subrahmanyam D: Effect of Ivermectin on filarial infections of *Mastomys natalensis*. *Parasitol Res* (Germany) 1990;76:521-526.
32. **Chandrashekar R**, Subrahmanyam D, Weil GJ: Effect of CGP 20376 on *Brugia malayi* and parasite antigenemia in jirds. *J Parasitol* 1991;77:479-482.
33. **Chandrashekar R**, Masood K, Alvarez RM, Ogunrinade AF, Lujan R, Richards FO, Weil GJ: Molecular cloning and characterization of recombinant parasite antigens for immunodiagnosis of onchocerciasis. *J Clin Invest* 1991;88:1460-1466.
34. Li BW, **Chandrashekar R**, Alvarez RM, Liftis F, Weil GJ: Identification of paramyosin as a potential protective antigen against *Brugia malayi* infection in jirds. *Mol Biochem Parasitol* 1991;49:315-324.
35. Rao UR, **Chandrashekar R**, Subrahmanyam D: Cell-mediated cytotoxicity of sera from diethylcarbamazine- and Ivermectin-treated rats on microfilariae *in vitro*. *Trop Biomed* 1991;8:1-6.
36. Rajasekariah GR, Parab PB, **Chandrashekar R**, Deshpande L, Subrahmanyam D: Pattern of *Wuchereria bancrofti* microfilaremia in young adolescent school students in Bassein, an endemic area for lymphatic filariasis. *Ann Trop Med Parasitol* (Liverpool) 1991;85:663-666.
37. Ogunrinade AF, Kale OO, **Chandrashekar R**, Weil GJ: Field evaluation of IgG<sub>4</sub> serology for the diagnosis of onchocerciasis in children. *Trop Med Parasitol* (Germany) 1992;43:59-61.
38. Weil GJ, Li BW, Liftis F, **Chandrashekar R**: *Brugia malayi*: Antibody responses to larval antigens in infected and immunized jirds. *Exp Parasitol* 1992;74:315-323.
39. Ogunrinade AF, **Chandrashekar R**, Weil GJ, Kale OO: Use of a recombinant antigen (OC 3.6) for the serological diagnosis of onchocerciasis in exposed Nigerian children. *J Trop Pediatr* (London) 1992;38:103-105.
40. Li BW, **Chandrashekar R**, Weil GJ: Vaccination with recombinant filarial paramyosin induces partial immunity to *Brugia malayi* infection in jirds. *J Immunol* 1993;150:1881-1885.
41. Ogunrinade AF, **Chandrashekar R**, Eberhard ML, Weil GJ: Preliminary evaluation of recombinant *Onchocerca volvulus* antigens for serodiagnosis of onchocerciasis. *J Clin Microbiol* 1993;31:1741-45.
42. **Chandrashekar R**, Ogunrinade AF, Henry RW, Lustigman S, Weil GJ: *Onchocerca volvulus*: Characterization of monoclonal antibodies to immune complex-associated parasite antigens. *Exp Parasitol* 1993;77:224-234.
43. **Chandrashekar R**, Curtis KC, Ramzy RM, Liftis F, Li B-W, Weil GJ: Molecular cloning of *Brugia malayi* antigens for diagnosis of lymphatic filariasis. *Mol Biochem Parasitol* 1993; 64:261-271.
44. **Chandrashekar R**, Curtis KC, Weil GJ. Molecular characterization of a circulating parasite antigen in sera from onchocerciasis patients that is immunologically cross-reactive with human keratin. *J Infect Dis* 1995; 171:1586-1592.
45. Eberhard ML, Tsang VC, Ottesen EA, **Chandrashekar R**, Weil GJ, Dickerson JW, Walker EM. Comparison of parasitologic and immunologic responses in primates experimentally infected with *Onchocerca volvulus*. *Exp Parasitol* 1995; 80:454-462.
46. Mehta K, **Chandrashekar R**: Transglutaminase activity in the microfilarial sheath. *Parasitology Today* 1995; 11:254.
47. **Chandrashekar R**, Van Swinderen B, Taylor H, Weil J. Effect of ivermectin prophylaxis on antibody responses to *Onchocerca volvulus* recombinant antigens in experimentally infected chimpanzees. *Int J Parasitol* 1995; 25:983.
48. Ramzy R, Helmy H, **Chandrashekar R**, Gad A, Faris R, Weil GJ. Evaluation of a recombinant antigen-based antibody assay for lymphatic filariasis in Egypt. *Ann Trop Med Hyg* 1995; 89:443-446.
49. Singh RN, **Chandrashekar R**, Mehta K. Purification and partial characterization of transglutaminase from a dog filarial parasite, *Dirofilaria immitis*. *Int J Biochem Cell Biol* 1995; 27:1285.
50. **Chandrashekar R**, Curtis KC, Li BW, Weil G. Molecular characterization of a *Brugia malayi* intermediate filament protein which is a major excretory-secretory product of adult worms. *Mol Biochem Parasitol* 1995; 73:231.
51. Mehta K, **Chandrashekar R**, Rao UR. Transglutaminase-catalyzed incorporation of a host protein (p68) on the surface of *Brugia malayi* microfilariae. *Mol Biochem Parasitol* 1996; 76:105.
52. Weil G, Ramzy RM, **Chandrashekar R**, Gad AM, Lowrie RC, Jr, Faris R. Parasite antigenemia without microfilaremia in bancroftian filariasis. *Am J Trop Med Hyg* 1996; 55:333.
53. **Chandrashekar R**, Ogunrinade AF, Weil GJ. Use of recombinant *Onchocerca volvulus* antigens for diagnosis and surveillance. *Tropical Medicine and International Health* 1996; 1:575.
54. **Chandrashekar R**, Curtis KC, Rawot BW, Kobayashi G, Weil GJ. Molecular cloning and characterization of a recombinant *Histoplasma capsulatum* antigen for diagnosis of human histoplasmosis. *J Clin Microbiol* 1997; 35, 1071-1076.
55. Klimowski L, **Chandrashekar R**, Tripp CA. Cloning, expression and enzymatic activity of a thioredoxin peroxidase from *Dirofilaria immitis*. *Mol Biochem Parasitol* 1997; 90:297.
56. **Chandrashekar R**, Tsuji, T, Morales, T, Ozols, V, Mehta, K. An ERp60-like protein from the filarial parasite *Dirofilaria immitis* has both transglutaminase and protein disulfide isomerase activity. *Proc Natl Acad Sci USA* 1998; 95:531.
57. Tsuji N, Morales T, Ozols V, Carmody A, **Chandrashekar R**. Molecular characterization of a calcium-binding protein from the filarial parasite *Dirofilaria immitis*. *Mol Biochem Parasitol* 1998; 97:69.

58. **Chandrashekar R**, Kurtis, KC, Lu, W, Weil GJ. Molecular cloning of an enzymatically active thioredoxin peroxidase from *Onchocerca volvulus*. *Mol Biochem Parasitol* 1998; **93**:309.
59. Tsuji N, Morales T, Carmody A, Ozols V, **Chandrashekar R**. Identification of an asparagine amidohydrolase from the filarial parasite *Dirofilaria immitis*. *Int J Parasitol* 1999; **29**:1451.
60. Helmy H, Weil GJ, Faris R, Gad AM, **Chandrashekar R**, Ashour A, Ramzy RMR. Human antibody responses to *Wuchereria bancrofti* infective larvae. *Parasite Immunol* 2000; **22**:89.
61. **Chandrashekar R**, Tsuji N, Morales T, Carmody A, Ozols V, Welton J, Tang L. Cloning and characterization of a 1-Cys peroxiredoxin from the filarial parasite *Dirofilaria immitis*. *Parasitol Res* 2000; **86**:200.
62. Tsuji N, Morales T, Ozols V, Carmody A, **Chandrashekar R**. Cloning and preliminary Characterization of a novel cuticular antigens from the filarial parasite *Dirofilaria immitis*. *Parasitol Int* 2000; **49**:321.
63. Ogunrinade AF, Awolola SO, Rotimi O, **Chandrashekar R**. Longitudinal studies of skin microfilaria and antibody conversion rates in children living in an endemic focus of onchocerciasis in Nigeria. *J Trop pediatr* 2000; **46**:348.
64. **Chandrashekar R**, Devarajan E, Mehta K. *Dirofilaria immitis*: further characterization of the transglutaminase enzyme and its role in larval molting. *Parasitology Res* 2002; **88**:185.

#### INVITED PUBLICATIONS

1. Mehta K, **Chandrashekar R**, Rao UR: Recent developments in antifilarial agents. *Current Opinion in Therapeutic Patents* (UK) 1992;**2**:641.
2. **Chandrashekar R**. Recent advances in the diagnosis of filarial infections. *Ind J Exp Biology*. 1997; **35**:18.
3. Frank, GR, Sabin, EA, **Chandrashekar, R**. Heartworm Vaccine and Immunology Research. In: *Recent Advances in Heartworm Disease: Symposium '98*. Ed. Seward RL. American Heartworm Society, Batavia, IL. 1998, pp 247-256.
4. **Chandrashekar R**, Mehta K. Transglutaminase-catalyzed reactions in the growth, maturation, and development of parasitic nematodes. *Parasitology Today*. 2000; **11**:17.
5. **Chandrashekar R**. Molecular Mechanisms of immune evasion by *Dirofilaria immitis*. Heartworm Vaccine and Immunology Research. In: *Recent Advances in Heartworm Disease: Symposium '01*. Ed. Seward RL. American Heartworm Society, Batavia, IL. 2001 (In Press).
6. **Chandrashekar R**. Novel Parasite Transglutaminase-Potential Drug Target. *Ind J Exp Biol*, 2002 (In Press).
7. Mehta K, Rao UR, **Chandrashekar R**. Transglutaminases of the lower organisms: Across the link between life and death. *Minerva Biotechnologica*, 2002 (In Press).